

Case note

ACS 2000 variable speed drive reduces energy consumption and improves process control of cement plant

Jura Cement, Switzerland's second largest cement producer, replaced a 25-year old cascade converter with a variable speed drive from ABB. The ACS 2000, rated at 550 kW, controls the clinker cooler exhaust fan of Jura Cement's cement plant in Wildegg, Switzerland.



Jura Cement's cement plant in Wildegg, Switzerland

Challenge

A 630 kW cascade drive was controlling the speed of a slip-ring induction motor on a clinker cooler exhaust fan at Jura Cement's Wildegg plant in Switzerland.

The clinker cooler exhaust fan plays a critical role in the cement making process. Raw mix enters the kiln and is heated to 1,450 degrees Celsius where it is transformed to clinker. Upon exiting the kiln, the clinker is cooled to 100 degrees Celsius by the clinker cooler fans which blow cooling air through the clinker.

By controlling the clinker cooler exhaust fan, the drive keeps the pressure in the kiln hood constant. It does this by regulating the fan speed that draws cold air through the clinker cooler in relation to the hot air that is being drawn through the kiln. Accurate energy input is critical to the quality of cement - insufficient heat will result in poorly burned low quality clinker whereas excess heat might damage the kiln shell.

Highlights

- Higher availability
- Reduced maintenance costs including no need to change carbon brushes
- Reduced spare parts stock
- Fast installation and commissioning
- Reduced energy consumption – estimated about 20%
- Wider range of speed control – from 0 to 1,000 rpm



Cement kiln at Jura Cement's cement plant in Wildegg, Switzerland

The cascade drive, that controlled the clinker cooler exhaust fan before, was built in 1984 by BBC. It has now been changed to a medium voltage AC drive, partly to give a broader speed range from 0 rpm to 1,000 rpm. The cascade drive was not operated below 300 rpm as the system's efficiency dropped considerably at lower speed. The limited speed range restricted some production phases, leading to high energy wastage.

Because of its age, the cascade drive was proving expensive to operate and maintain as the carbon brushes needed replacing on the machines every three months. Furthermore, because the technology employed within the drive included discrete components, they were more susceptible to breakdown. Spare parts for the cascade drive were becoming scarce.

As cement making is a continuous process the drive needs to operate 24 hours a day and only be taken off line at planned maintenance intervals. With each kiln stop costing several thousand Swiss Francs, maximizing uptime of the process is paramount.

In addition, for environmental and financial reasons, Jura Cement was keen to reduce the energy consumption of the cooler exhaust fan.

Solution

An ABB 550 kW, 6 kV medium voltage drive was chosen to replace the cascade drive on the cooling fan located immediately after the 2,000 tonnes, 56 meters long Polysius kiln.

The incoming electricity supply is stepped down from 8 kV to the 6 kV needed by the medium voltage drive.

Despite the fact that the ACS 2000 offers all the advantages of a Voltage Source Inverter (VSI) such as high and constant power factor and several state-of-the-art features such as an Active Front End for reduced harmonics, it was the more basic reasons of simple installation, commissioning and operation that attracted plant electrical engineer Jürg Hitz to the drive.

Benefits

Fast installation and commissioning

Being a general purpose drive for standard applications, installation and commissioning could be carried out extremely rapidly, with hot commissioning taking only one day.

This can be partly attributed to the standardization built into the product. As such the installation does not require entire engineering teams.

ABB's scope of supply included a complete server-client based System 800xA, the entire I/O hardware as well as the supervision of erection and commissioning.

The medium voltage drive's interface with the new ABB 800xA control system is via Profibus using a single cable, as opposed to many connections with the previous drive system. This is a big advantage during commissioning, as it takes minutes to commission a fieldbus control system compared to other hard wired systems.

The simplicity of the installation and commissioning is also reflected in the reduced training time needed for end-users. "It really is as simple as a black box approach with a simple on/off function if that is all that is needed," says Jürg Hitz, plant electrical engineer at Jura Cement, Wildegg.



The clinker cooler exhaust fan motor controlled by ABB's ACS 2000 variable speed drive.

Reduced maintenance costs

With its small footprint the drive gives considerable space saving compared to the cascade drive. Also due to the difference in the new technology to the old, there is a great reduction in maintenance time and costs.

“The kiln had to be stopped up to 30 times per year. Some stoppages were the result of brush changes to the slip ring motors. Based on the experience from the ACS 2000's performance, Jura Cement expects that there will be no kiln stops because of the drive's maintenance or performance” says Hitz.

As cement making is a continuous process and the drive needs to operate 24 hours a day and only be taken off line at planned maintenance intervals this is of paramount importance.

The design also features easily replaceable phase modules which allow the end-user to rapidly replace a module within minutes. This means that, even in the unlikely event that a phase module needs to be exchanged, the kiln does not have to be stopped as the drive can be put back into operation very fast.

“The whole system is modular and so we think that with some spare parts our maintenance team can make changes in a very short time. That is what maintenance people are looking for.”

Energy savings

Cement plants use a lot of energy and technologies that help cut the high energy bills are well regarded. One of the biggest benefits of installing the ACS 2000 drive system compared to a cascade drive system is the energy saving potential.

The kiln fan is one of the largest consumers of energy in a cement plant. Controlling a kiln fan with an electric variable speed drive can result in significant energy savings.

Jura Cement and ABB are planning to monitor the energy consumption and compare this against that consumed by the cascade drive. Already Hitz is predicting substantial reduction in energy consumption of about 10 to 20 percent.

“We can easily recover the investment cost of the drive from energy saving alone,” says Hitz. “This drive works 24 hours a day, therefore payback will be rapid.”

Wider range of speed control

Compared to the limited speed range of the cascade drive – from 30 to 100 percent - the ACS 2000 offers a wider speed range from 0 to 100 percent, resulting in a much better process control.

“The wider range of speed control gives us a higher overall efficiency as we have now greater control over the entire process” says Hitz.

The success of the ACS 2000 means that two further medium voltage applications are now being considered. “I like systems that make no trouble for me,” says Jürg Hitz. “Since we have commissioned this drive the results are good. We believe this is a drive for the future and one that can be installed at other places in our plant.”

Jura Cement

With an annual production capacity of approximately one million tonnes, Jura Cement is Switzerland's second largest cement producer and is part of JURA-Holding. Jura Cement's plants in Wildeggen and Cornaux produce high-quality cement for different fields of application.

Since 2000 JURA-Holding belongs to CRH plc (Cement Roadstone Holding), an international leader in building materials, headquartered in Dublin.



Key data of ACS 2000 product family

Inverter type	Multilevel Voltage Source Inverter (VSI)
Power range	250 - 1,600 kW
Output voltage	4.0 - 6.9 kV
Maximum output frequency	75 Hz
Converter efficiency	Typically 97.5%
Type of motor	Induction motor

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